

An explanatory model of loneliness and suicidal ideation in Peruvian adolescents: the mediating role of non-suicidal self-injury

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KEYWORDS

Adolescent mental health
Self-injurious behavior
Psychosocial factors
Psychological well-being
Suicide risk

ABSTRACT

The present study aimed to examine the mediating role of nonsuicidal self-injury in the relationship between loneliness (social and emotional) and suicidal ideation among Peruvian adolescents. A cross-sectional explanatory study was conducted with a sample of 434 adolescents aged 14 to 17 years from three public educational institutions. Validated instruments were used to assess loneliness, suicidal ideation, and nonsuicidal self-injury, and the proposed model was tested using structural equation modeling with the robust maximum likelihood (MLR) estimator. The results showed that both social and emotional loneliness were positively and significantly associated with suicidal ideation; furthermore, nonsuicidal self-injury mediated both relationships. Regarding gender differences, female adolescents reported higher levels of emotional loneliness, nonsuicidal self-injury, and suicidal ideation. It is concluded that adolescents who experience loneliness may engage in nonsuicidal self-injury as a maladaptive coping mechanism, which is associated with greater suicidal ideation.

Un modelo explicativo de la soledad y la ideación suicida en adolescentes peruanos: el rol mediador de la autolesión no suicida

PALABRAS CLAVE

Salud mental adolescente
Comportamiento
autolesivo
Factores psicosociales
Bienestar psicológico
Riesgo suicida

RESUMEN

El presente estudio tuvo como objetivo examinar el rol mediador de la autolesión no suicida en la relación entre la soledad (social y emocional) y la ideación suicida en adolescentes peruanos. Se desarrolló un estudio explicativo de corte transversal con una muestra de 434 adolescentes, con edades entre 14 y 17 años, provenientes de tres instituciones educativas públicas. Se emplearon instrumentos validados para evaluar la soledad, la ideación suicida y la autolesión no suicida, y se analizó el modelo propuesto mediante ecuaciones estructurales con el estimador de máxima verosimilitud robusta (MLR). Los resultados evidenciaron que la soledad social y emocional se asociaron positiva y significativamente con la ideación suicida; asimismo, la autolesión no suicida desempeñó un rol mediador en ambas relaciones. En cuanto a las diferencias según género, las mujeres presentaron puntuaciones más elevadas en soledad emocional, autolesiones e ideación suicida. Se concluye que los adolescentes que experimentan soledad pueden recurrir a la autolesión no suicida como mecanismo de afrontamiento desadaptativo, lo que se asocia con una mayor ideación suicida.

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Suicidal ideation constitutes a serious public health problem (Bao et al., 2024), as it poses a significant threat to adolescent well-being and is a risk factor for suicide (Have et al., 2009; Lee & Ham, 2018). Suicide was considered the third leading cause of death worldwide in 2021 (World Health Organization [WHO], 2025). In Latin America, suicide rates reached 9.8 per 100,000 population among individuals aged 15 to 49 years (Our World in Data, 2024). In Peru, the rate was 0.9 among children aged 10 to 14 years and 1.9 among adolescents aged 15 to 19 years (Pan American Health Organization [PAHO], 2021). In addition, 4,053 suicide attempt cases were reported in 2025, with adolescents (12 to 19 years) ranking second among the affected age groups: 28.77% were male and 17.79% were female (Centro Nacional de Epidemiología, Prevención y Control de Enfermedades [CDC], 2025). These data indicate that the problem remains prevalent among adolescents, with a greater tendency among males.

Suicidal ideation

According to the World Health Organization, suicidal ideation is part of suicidal behavior, along with suicide planning and suicide attempts (Bahamón Muñetón et al., 2019). It is defined as an intrapsychic phenomenon in which an individual experiences one or more thoughts related to behaviors aimed at ending one's own life (Ribeiro & Guerra, 2020). Suicidal ideation poses a risk to both life and emotional well-being, particularly among adolescents (Ribeiro & Guerra, 2020; Vargas-Murga et al., 2025). Among Peruvian adolescents, 8.9% have been found to experience suicidal ideation, with a higher prevalence among females than males (11.3% vs. 5.9%; Hernández-Vásquez et al., 2023). Therefore, the risk of attempting suicide is substantial (Baños-Chaparro & Contreras-Núñez, 2025).

Loneliness and suicidal ideation

Within this context, it is necessary to examine the risk factors that predispose adolescents to suicidal ideation. Among these factors, loneliness has received particular attention. According to Hawkley and Cacioppo (2010), loneliness is characterized by distress arising from experiences in which there is a perceived discrepancy between desired and actual social relationships. However, it differs from social isolation, in which the lack of social interactions is objectively observable. Loneliness is a construct that may manifest socially and/or emotionally. On the one hand, social loneliness is characterized by a lack of integration into a group (e.g., friends or neighbors), making it more closely associated with the quantity of social relationships than with their quality (Ulutas & Aksoy, 2014). On the other hand, emotional loneliness reflects the absence of close and intimate relationships (e.g., family relationships); that is, it involves a perceived lack of emotional support or intimate connection with one or more significant others (Lavelle & Hawkley, 2010). In this regard, Weiss (1973) noted that these two forms of loneliness arise from the absence of fundamentally different types of relationships, namely attachment (family) versus integration (social group).

Evidence indicates that individuals who experience higher levels of loneliness are more likely to report suicidal thoughts and behaviors (Hu et al., 2025; Lee & Lee, 2026; Wang et al., 2025). Furthermore, loneliness predicts internalizing problems (e.g., depression and anxiety), which in turn increase the risk of suicidal ideation (Wang et al., 2025; Yang et al., 2023). Some studies have reported gender differences in the effect of loneliness on suicidal ideation among adolescents. For example, among U.S. adolescents, loneliness was reported to have a stronger effect on suicidal ideation among females than among males (Pollak et al., 2025). In addition, Slovenian adolescents with suicidal ideation were found to report greater loneliness and lower family support, with the frequency of suicidal ideation differing by gender and being higher among females (Bračič et al., 2019).

Nonsuicidal self-injury and suicidal ideation

Nonsuicidal self-injury is defined as the deliberate act of causing physical injury to oneself without lethal intent (Nock, 2010; Nock & Favazza, 2009). Evidence suggests that these behaviors provide temporary relief from psychological distress (Otto et al., 2023). Adolescents who engage in nonsuicidal self-injury are at greater risk of experiencing suicidal ideation (Poudel et al., 2022). This association is often attributed to the emotional distress underlying both behaviors (Grandclerc & Lachal, 2018). Therefore, the presence of self-injury may indicate greater emotional distress, thereby increasing adolescents' vulnerability to suicidal thoughts. In addition, repeated self-injury may reduce sensitivity to pain and fear of death (Joiner, Van Orden & Witte, 2009).

Mediating role of nonsuicidal self-injury in the relationship between loneliness and suicidal ideation, and gender as a differentiating factor

Integrating the evidence presented thus far suggests that nonsuicidal self-injury may be used as a maladaptive coping strategy to manage overwhelming emotions such as loneliness. This may create a cycle in which the temporary relief of emotional pain through self-injury leads to greater isolation and, consequently, exacerbates suicidal ideation. This phenomenon can be explained by the interpersonal theory of suicide, which proposes three factors: thwarted belongingness, perceived burdensomeness, and acquired capability for suicide (Joiner, Van Orden & Witte, 2009). Loneliness is associated with thwarted belongingness, whereas nonsuicidal self-injury is associated with acquired capability for suicide. Thwarted belongingness involves a lack of connection with others (Espinosa-Salido et al., 2021; Joiner, Van Orden, Witte et al., 2009), whereas acquired capability develops through repeated exposure to painful experiences, such as self-injury (Ribeiro & Joiner, 2009). In this regard, evidence indicates that individuals with a history of self-injury or other painful experiences exhibit greater acquired capability for suicide, making them more likely to attempt suicide when experiencing suicidal ideation (Barzilay et al., 2015; Brackman et al., 2016).

On the other hand, gender is not merely a descriptive characteristic but also a relevant variable for understanding how loneliness, nonsuicidal self-injury, and suicidal ideation are interrelated during adolescence. Evidence has shown that these experiences do not manifest uniformly across males and females (Baños-Chaparro & Contreras-Núñez, 2025; Have et al., 2009), particularly with regard to the role of loneliness as an indicator of suicide risk (Bračič et al., 2019; Pollak et al., 2025). This supports the assumption that nonsuicidal self-injury and suicidal ideation may differ according to adolescents' gender, particularly given that females may show greater vulnerability to forms of interpersonal and emotional distress associated with this process.

The present study

The primary aim of this study was to examine the mediating role of nonsuicidal self-injury as an explanatory mechanism in the relationship between loneliness (emotional and social) and suicidal ideation. A model was proposed in which loneliness is associated with higher levels of suicidal ideation and may also contribute indirectly to suicidal ideation through nonsuicidal self-injury, understood as a dysfunctional coping strategy for managing emotional distress. In addition, loneliness, nonsuicidal self-injury, and suicidal ideation were expected to differ according to adolescents' gender, particularly given that females may show greater vulnerability to forms of interpersonal and emotional distress associated with this process.

Given the limited empirical evidence on this process, particularly among Peruvian adolescents, this study contributes relevant knowledge to the understanding of risk factors in adolescent mental health. It is also aligned with Sustainable Development Goal 3, which promotes mental health and the reduction of preventable mortality by 2030, underscoring the importance of identifying evidence-based risk factors to strengthen suicide prevention efforts (Dattani et al., 2023).

Additionally, considering previous evidence suggesting gender differences in the experience of loneliness, self-injurious behaviors, and suicidal ideation during adolescence (Bračič et al., 2019; Pollak et al., 2025), a secondary aim was to examine gender differences in the variables assessed and to evaluate the structural equivalence of the proposed model across males and females.

Consistent with the study objectives, the following hypotheses were formulated: H1. Social loneliness is positively associated with suicidal ideation; H2. Emotional loneliness is positively associated with suicidal ideation; H3. Nonsuicidal self-injury mediates the relationship between social loneliness and suicidal ideation; H4. Nonsuicidal self-injury mediates the relationship between emotional loneliness and suicidal ideation; H5. There are gender differences in levels of loneliness (social and emotional), nonsuicidal self-injury, and suicidal ideation; and H6. The proposed model demonstrates structural equivalence across males and females.

Method

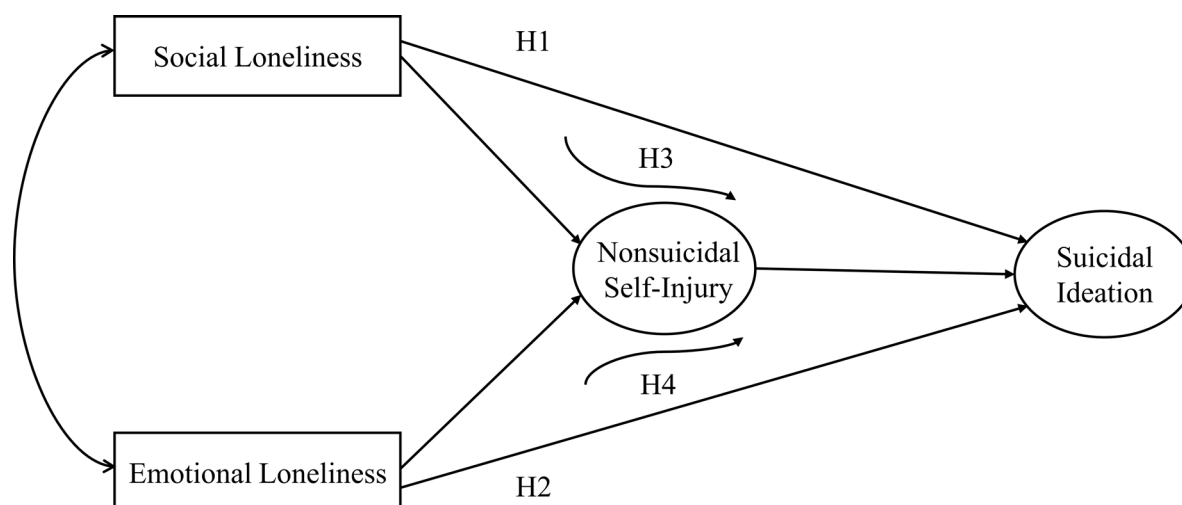
Participants

A cross-sectional explanatory study was conducted. The model was analyzed using structural equation modeling (SEM) and included observed variables (social loneliness and emotional loneliness) and latent variables (nonsuicidal self-injury and suicidal ideation) (Ato & Vallejo, 2015).

The required sample size was determined using Soper's (2024) online calculator for SEM, which considers the number of latent and observed variables, the anticipated effect size ($\lambda = .2$), statistical power of 95%, and the desired significance level ($\alpha = .05$), yielding a recommended sample size of 368 participants. The inclusion criteria were as follows: (a) being enrolled in secondary education, (b) having informed consent from a parent or legal guardian, (c) providing informed assent for participants who were minors, and (d) residing in the city

Figure 1

Theoretical model



of Chimbote, Peru. The following exclusion criteria were also applied: (a) questionnaires with incomplete information and (b) participants who had difficulty understanding or adequately responding to the questionnaires.

The final sample consisted of 434 adolescents of both genders (51.6% male and 48.4% female), aged 14 to 17 years ($M = 15.6$, $SD = 0.94$), attending public educational institutions in the city of Chimbote, Peru. Participants were selected through nonprobability convenience sampling. Of the total sample, 259 (59.68%) reported at least one indicator of suicidal ideation; likewise, 246 (56.68%) and 155 (35.71%) reported at least one indicator of minor and major self-injury, respectively.

Measures

De Jong Gierveld Loneliness Scale. This scale was developed by De Jong-Gierveld and Kamphuis (1985) and validated in Peru by Ventura-León et al. (2017). It consists of 11 items rated on a three-point scale (1 = *no*; 2 = *more or less*; and 3 = *yes*) and comprises two factors: social loneliness (e.g., “I miss having a really close friend”), with five items, and emotional loneliness (e.g., “I experience a general sense of emptiness”), with six items. In the present study, the two-factor structure showed an acceptable fit (CFI = .92, TLI = .9, RMSEA = .061, 90% CI [.047, .076], SRMR = .05), as well as adequate reliability for both factors: social loneliness ($\omega = .76$) and emotional loneliness ($\omega = .73$).

Paykel Suicide Scale (PSS). Developed by Paykel et al. (1974) and validated in Peru by Baños-Chaparro and Ramos-Vera (2020), the PSS consists of five items assessing the presence of suicidal ideation using a dichotomous response format (*Yes* = 1; *No* = 0). In the present study, PSS scores showed an acceptable fit (CFI = .94, TLI = .91, RMSEA = .081, 90% CI [.045, .121], SRMR = .044), together with adequate reliability ($\omega = .86$).

Self-Injury Questionnaire (CAL). This instrument was developed by Marin (2013) and validated in Peru by Quevedo et al. (2021). It assesses the presence of nonsuicidal self-injury through 12 items organized into two dimensions: minor self-injury (e.g., “Making yourself bleed”) and major self-injury (e.g., “Cutting yourself until you injure or make your skin bleed”), each consisting of six items. The occurrence of each behavior is initially recorded using a dichotomous response format (*Yes* = 1; *No* = 0). When the response is affirmative, frequency is also assessed using a five-category scale ranging from 1 (once) to 5 (twenty or more times). Scores range from 0 to 30 for each dimension and from 0 to 60 for the total self-injury score. In the present sample, the scale was analyzed using a second-order model, which showed an acceptable fit (CFI = .91, TLI = .9, RMSEA = .047, 90% CI [.038, .055], SRMR = .065), with adequate reliability for the major self-injury ($\omega = .76$) and minor self-injury ($\omega = .78$) dimensions, as well as for the total scale score ($\omega = .82$). The specification of a second-order factor was supported by the strong association observed between the minor and major self-injury dimensions, as well as by the conceptualization of both dimensions as manifestations of a higher-order construct of nonsuicidal self-injury.

Procedure

This study complied with the ethical guidelines established in the Declaration of Helsinki (World Medical Association, 2013) and received approval from the Ethics Committee of a Peruvian university (approval code: 00755-2024/CEI-PSI). Before administering the questionnaires, the School of Psychology sent formal letters to the principals of five schools selected through nonprobability convenience sampling, based on institutional accessibility and willingness to participate in the study. Three institutions granted the corresponding authorization. Following formal approval from the school principals and academic coordinators, access was arranged to 18 classrooms from the third to fifth years of secondary education, selected according to institutional authorization and academic availability during the data collection period. The instruments were administered by previously trained members of the research team. The teachers responsible for the classes remained in the classroom due to institutional requirements and for general student supervision; however, they did not participate in the assessment process or have access to the participants' responses.

Because the participants were minors, informed consent was obtained in advance from their parents or legal guardians, along with informed assent from the students. Before the questionnaires were administered, participants were informed of the purpose of the study, with emphasis on the voluntary nature of their participation and their right to withdraw at any time without consequences. All participants who agreed to take part in the study were assessed anonymously and confidentially, with measures implemented to protect their information and minimize ethical risks. Data were collected in person between October and December 2024.

Data analysis

Descriptive statistics were analyzed to examine the distribution of scores, using ± 2 as the criterion for skewness and kurtosis (George & Mallery, 2019). The Mann–Whitney U test was used to examine gender differences, and the rank-biserial correlation coefficient was calculated to estimate the effect size of these differences (Dominguez-Lara, 2018). Correlations were estimated using Spearman's method.

Relationships among the variables and mediation effects were evaluated using SEM. The social loneliness and emotional loneliness dimensions were included as observed variables using composite scores to preserve model parsimony and optimize the balance between parametric complexity and the available sample size (Kline, 2016). The structural model was estimated using robust maximum likelihood (MLR) because of the deviation from multivariate normality (Muthén & Muthén, 2017). Model fit was evaluated according to the following criteria: CFI and TLI values greater than .9 and RMSEA and SRMR values below .08 (Kline, 2016). Mediation analyses were estimated using bootstrap resampling with 5,000 iterations. The significance of the indirect effects was evaluated using 95% bootstrap confidence intervals (Yzerbyt et al., 2018). Mea-

surement invariance was assessed using a stepwise approach by comparing the fit of progressively more restrictive models: configural invariance, metric invariance, scalar invariance, and regression invariance. A significant decrease in model fit ($\Delta\text{CFI} < .01$ and $\Delta\text{RMSEA} > .015$ or $\Delta\text{SRMR} > .03$) would indicate differences in the model (Chen, 2007). In addition, the Wald test was used to examine gender differences in the mediation model (Wang & Wang, 2019).

Reliability was estimated using the omega coefficient (ω), with values between .7 and .9 considered acceptable (Campo-Arias & Oviedo, 2008). Statistical analyses were performed in the R environment (version 4.5.0) using the “lavaan” and “semTools” packages (Rosseel, 2012).

Results

Skewness ranged from -0.55 to 2.09 , and kurtosis ranged from -1.17 to 3.89 . According to the ± 2 criterion, major self-injury exceeded the adopted limits for univariate normality, showing a concentration of scores at the lower end of the distribution and greater peakedness. Correlations ranged from .18 to .66. In addition, Mardia's skewness coefficient ($g1 = 23812.58$, $p < .001$) and kurtosis coefficient ($g2 = 103.27$, $p < .001$) indicated a deviation from multivariate normality (see Table 1).

Table 2 showed higher scores among females for all variables except social loneliness, for which no statistically significant

differences were observed; effect sizes were small to moderate.

The proposed mediation model for the total sample showed an acceptable fit ($\text{CFI} = .95$, $\text{TLI} = .92$, $\text{RMSEA} = .086$, $90\% \text{ CI} [.071, .107]$, $\text{SRMR} = .04$). Figure 2 shows positive and significant effects of both dimensions of loneliness on nonsuicidal self-injury and of nonsuicidal self-injury on suicidal ideation. When nonsuicidal self-injury was included as a mediator, the direct effect of social loneliness on suicidal ideation was not statistically significant, whereas the direct effect of emotional loneliness remained positive and significant. Nevertheless, the total effects of both dimensions of loneliness on suicidal ideation were positive and significant, supporting hypotheses H1 and H2. The indirect effects were statistically significant, and their 95% confidence intervals did not include zero, supporting the mediating role of nonsuicidal self-injury in both the relationship between social loneliness and suicidal ideation and the relationship between emotional loneliness and suicidal ideation. Consequently, hypotheses H3 and H4 were supported (see Table 3).

To examine the structural equivalence of the model across gender, a multigroup SEM was estimated. The model showed an acceptable fit in both groups. Differences in goodness-of-fit indices were minimal: $\Delta\text{CFI} < .01$, $\Delta\text{RMSEA} < .015$, and $\Delta\text{SRMR} < .03$ (see Table 4), supporting model invariance across males and females. Wald tests were subsequently conducted to examine gender differences in path coefficients and mediation

Table 1

Descriptive statistics, correlations, and normality of the study variables

Variables	<i>M</i>	<i>SD</i>	<i>g1</i>	<i>g2</i>	1	2	3	4	5
1. Social loneliness	3.18	1.69	-0.55	-0.99	-				
2. Emotional loneliness	3.36	1.87	-0.23	-1.08	.23**	-			
3. Major self-injury	1.71	3.11	2.09	3.89	.2**	.29**	-		
4. Minor self-injury	3.4	4.74	1.64	1.96	.18**	.27**	.66**	-	
5. Suicidal ideation	1.78	1.86	0.57	-1.17	.19**	.36**	.5**	.45**	-

Note. *M* = Mean; *SD* = Standard deviation; *g1* = Skewness; *g2* = Kurtosis; $p < .05$. $p < .01$.

Table 2

Comparative analysis by gender

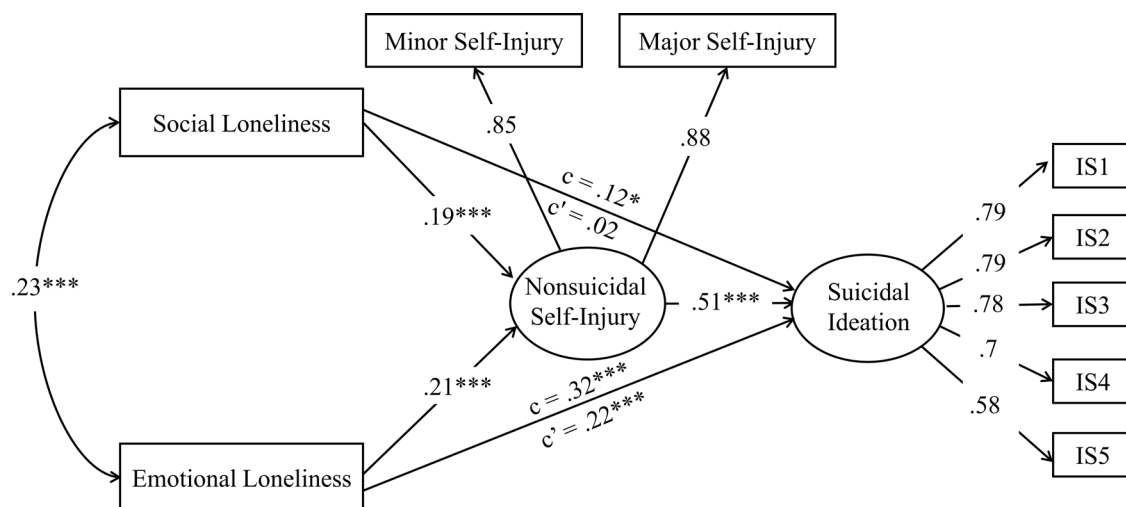
Variable	Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>U</i>	<i>p</i>	<i>rbis</i>
Social loneliness	Females	210	3.14	1.7	22,836	.592	-.03
	Males	224	3.21	1.69			
Emotional loneliness	Females	210	3.56	1.77	20,964	.048	.11
	Males	224	3.18	1.94			
Major self-injury	Females	210	2.22	3.38	18,821	< .001	.2
	Males	224	1.23	2.77			
Minor self-injury	Females	210	4.03	5	19,358	< .001	.18
	Males	224	2.81	4.42			
Suicidal ideation	Females	210	2.32	1.86	15,761	< .001	.33
	Males	224	1.26	1.71			

Note. *n* = Sample size; *M* = Mean; *SD* = Standard deviation; *U* = Mann–Whitney U statistic; *p* = statistical significance; *rbis* = rank-biserial correlation.

Table 3*Indirect effects of the mediation model in the total sample and by gender*

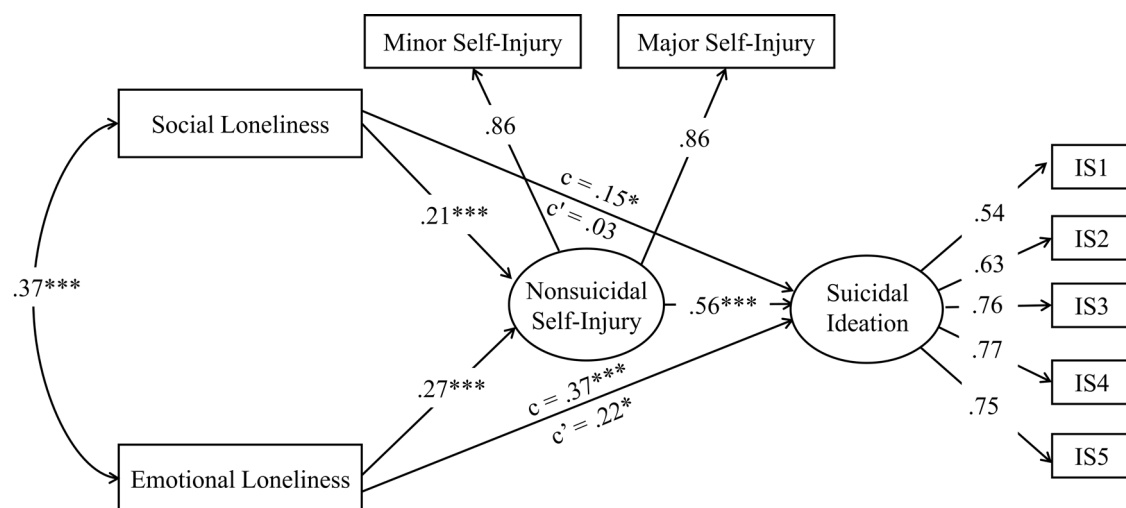
Sample	Relationships	B	β	p	CI 95 %	
					LI	LS
Total	Social loneliness → nonsuicidal self-injury → suicidal ideation	.016	.1	< .001	.009	.023
	Emotional loneliness → nonsuicidal self-injury → suicidal ideation	.016	.11	< .001	.008	.026
Females	Social loneliness → nonsuicidal self-injury → suicidal ideation	.019	.12	< .001	.008	.031
	Emotional loneliness → nonsuicidal self-injury → suicidal ideation	.023	.15	< .001	.01	.038
Males	Social loneliness → nonsuicidal self-injury → suicidal ideation	.01	.06	.027	0	.018
	Emotional loneliness → nonsuicidal self-injury → suicidal ideation	.008	.06	.117	-.001	.018

Note. B = unstandardized coefficient; β = standardized coefficient; 95% CI = 95% confidence interval; LL = lower limit; UL = upper limit.

Figure 2*Structural mediation model in the total sample*

Note. Standardized coefficients are presented. c = total effect; c' = direct effect.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 3*Structural mediation model in the female sample*

Note. Standardized coefficients are presented. c = total effect; c' = direct effect.

* $p < .05$, ** $p < .01$, *** $p < .001$.

effects. The results showed that the structural paths did not differ overall between the two groups (Wald $\chi^2 = 8.72$, $df = 5$, $p = .121$). Specific contrasts likewise revealed no significant differences in the associations between social loneliness and nonsuicidal self-injury (Wald $\chi^2 = 1.04$, $df = 1$, $p = .308$), emotional loneliness and nonsuicidal self-injury (Wald $\chi^2 = 3.16$, $df = 1$, $p = .076$), or nonsuicidal self-injury and suicidal ideation (Wald $\chi^2 = 0.74$, $df = 1$, $p = .389$), nor in the direct effects of social loneliness (Wald $\chi^2 = 0.01$, $df = 1$, $p = .923$) and emotional loneliness (Wald $\chi^2 = 0.74$, $df = 1$, $p = .388$) on suicidal ideation. Regarding mediation, the indirect effect of emotional loneliness on suicidal ideation through nonsuicidal self-injury differed significantly between males and females (Wald $\chi^2 = 3.92$, $df = 1$, $p = .048$), with a significant mediation effect among females ($\beta = .15$, $p < .001$) but not among males ($\beta = .05$, $p = .117$). However, no gender differences were found in the indirect effect of social loneliness (Wald $\chi^2 = 2.37$, $df = 1$, $p = .123$) or in the total effects of social loneliness (Wald $\chi^2 = 0.54$, $df = 1$, $p = .464$) and emotional loneliness (Wald $\chi^2 = 3.49$, $df = 1$, $p = .062$).

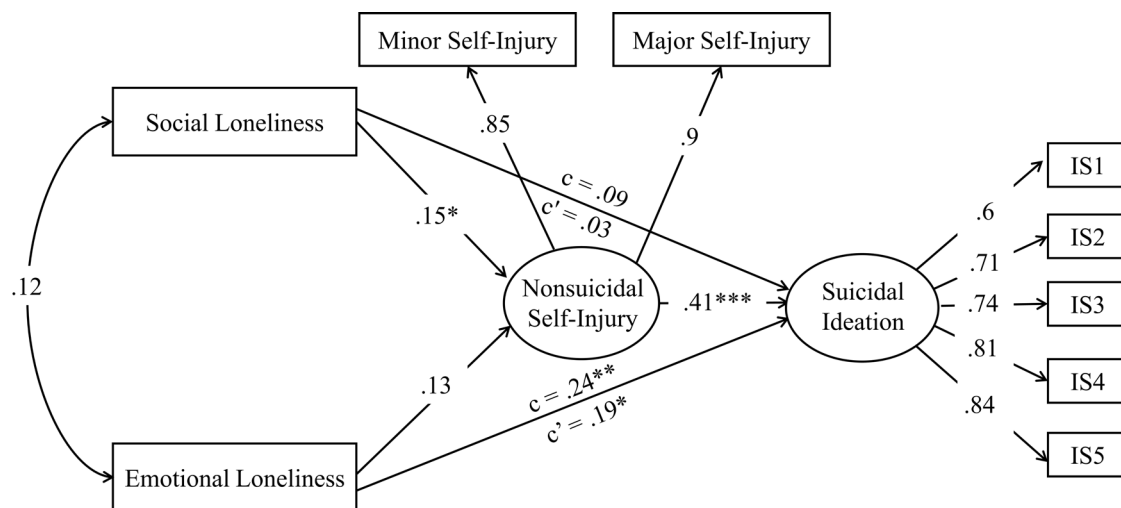
Discussion

The results of this study indicated that the proposed model supported the hypotheses. The total effects of emotional loneliness and social loneliness on suicidal ideation were positive and statistically significant. This finding is consistent with previous empirical evidence identifying loneliness as a relevant predictor of suicidal thoughts among adolescents (Hu et al., 2025; Lee & Lee, 2026; Wang et al., 2025). These results may be explained by considering that, during adolescence, the perception of a lack of acceptance or meaningful emotional bonds can generate emotional distress, processes that increase the risk of suicidal ideation (Yang et al., 2023).

It was also confirmed that nonsuicidal self-injury plays a mediating role in the relationship between loneliness (social and emotional) and suicidal ideation. Based on Joiner's Interpersonal Theory of Suicide, loneliness reflects a condition of thwarted belongingness characterized by perceived interpersonal disconnection and the absence of meaningful relationships (Joiner, Van Orden & Witte, 2009). In response to this distress, some adolescents may engage in nonsuicidal self-injury as a maladaptive coping strategy to temporarily alleviate emotional distress

Figure 4

Structural mediation model in the male sample



Note. Standardized coefficients are presented. c = total effect; c' = direct effect.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4

Fit of the mediation model and multigroup comparison between females and males

	Model Fit Indices					Multigroup Comparison		
	χ^2 (df)	RMSEA (90 % CI)	CFI	TLI	SRMR	Δ CFI	Δ RMSEA	Δ SRMR
M1	124.102 (49)	.09 (.07, .11)	.939	.913	.055			
M2	129.001 (54)	.086 (.067, .105)	.939	.921	.061	.000	.004	-.006
M3	137.913 (59)	.084 (.066, .102)	.936	.924	.063	.003	.002	-.002
M4	140.515 (61)	.083 (.065, .101)	.936	.926	.075	.000	.001	-.012

Note. Females and males were compared. M1 = configural model; M2 = metric model; M3 = scalar model; M4 = model with constrained regressions; Δ = change relative to the preceding model; df = degrees of freedom; CI = confidence interval.

(Nock, 2010; Otto et al., 2023). Repetition of these behaviors increases exposure to physical pain and strengthens acquired capability for suicide, facilitating the progression from interpersonal vulnerability to suicidal ideation (Joiner, Van Orden & Witte, 2009).

Within the Peruvian context, this finding expands the available evidence on suicidal behavior among adolescents, which has focused primarily on describing prevalence rates and emotional factors associated with suicide risk (Baños-Chaparro & Contreras-Núñez, 2025; Vargas-Murga et al., 2025). In particular, the results suggest that nonsuicidal self-injury constitutes a relevant mechanism through which experiences of loneliness may increase the likelihood of suicidal ideation among Peruvian adolescents.

Females reported higher scores for emotional loneliness, self-injury, and suicidal ideation. This finding indicates that, although the difference does not necessarily lie in a lack of social interactions, females more frequently experience a perceived lack of emotional closeness, which is consistent with evidence suggesting greater sensitivity among females to emotional relationships (Barreto et al., 2021). Likewise, higher levels of self-injury and suicidal ideation among females have been documented in adolescent samples (Bresin & Schoenleber, 2015; Nock et al., 2006). These results are also consistent with evidence from Peruvian adolescents, among whom higher levels of self-injurious behaviors have been observed in females compared with males (Morales-Pérez et al., 2025), as well as a higher frequency of suicidal ideation and planning among adolescent females (Vargas-Murga et al., 2025).

Regarding the structural equivalence of the model, the findings supported gender invariance, indicating that the relationships among the variables follow a conceptually similar organization in both groups. This evidence suggests that the mechanisms proposed by the Interpersonal Theory of Suicide exhibit a relatively stable structure regardless of gender. This result was corroborated by the joint Wald test, which showed no statistically significant differences between males and females across the set of structural paths. However, only the indirect effect of emotional loneliness on suicidal ideation through self-injury differed between groups and was stronger among females. These findings are consistent with previous studies reporting greater sensitivity among females to experiences of interpersonal disconnection and a stronger association between loneliness and suicide risk (Bračić et al., 2019; Pollak et al., 2025). In this sense, the evidence obtained suggests that gender does not alter the structure or equivalence of the model—that is, the overall configuration of the psychological process linking loneliness to suicidal ideation—but may modulate the magnitude with which specific risk factors operate within this process.

Practical implications

The results highlight the need to consider nonsuicidal self-injury as a critical risk indicator, particularly among adolescents who self-report high levels of loneliness. Early identification of experiences of social isolation or emotional emptiness

may facilitate targeted interventions aimed at interrupting progression toward self-injurious behaviors and suicidal thoughts. Likewise, these findings reinforce the importance of incorporating multidimensional assessments of loneliness in school and community settings, particularly in middle-income countries such as Peru, where empirical evidence on these processes remains limited.

Limitations and future directions

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes establishing causal relationships among the variables; therefore, longitudinal studies would allow for a more precise examination of the directionality and magnitude of these relationships over time in adolescent populations. Second, the sample consisted of adolescents from a single region of the country and was selected using nonprobability convenience sampling. Although the sample size was sufficient to ensure adequate statistical power, this sampling procedure limits the generalizability of the findings to all Peruvian adolescents and to other sociocultural contexts. Third, the use of self-report measures may have introduced biases associated with social desirability. Future research could complement these findings through data triangulation methods that provide a more robust assessment of the phenomenon.

Regarding future research directions, it would be important to examine the stability and generalizability of the proposed model in adolescent samples from different sociocultural contexts. Longitudinal studies are also needed to analyze the temporal sequence through which loneliness contributes to the development of self-injurious behaviors and, subsequently, to the emergence of suicidal ideation. Given that the indirect effect of emotional loneliness on suicidal ideation through self-injury was stronger among females, future studies could explore the mechanisms underlying this difference. Finally, it would be relevant to evaluate models derived from the Interpersonal Theory of Suicide that explicitly incorporate constructs such as thwarted belongingness and acquired capability for suicide, with the aim of more precisely understanding the psychological processes linking loneliness, nonsuicidal self-injury, and suicidal ideation during adolescence.

Conclusions

The findings of the present study indicate that nonsuicidal self-injury functions as a mediator in the relationship between loneliness and suicidal ideation among Peruvian adolescents. By integrating interpersonal and behavioral variables into the explanatory model, the study provides context-specific empirical evidence that contributes to a more comprehensive understanding of the processes underlying suicidal ideation. Within this framework, these findings not only expand the existing theoretical foundation but also provide a basis for future research aimed at adolescent suicide prevention, in line with current mental health challenges.

Author contributions

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Conflict of interests

The authors declare that there is no conflict of interests.

Data availability statement

The data supporting the findings and conclusions of this study are available from the corresponding author upon request.

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